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What is fast timing?

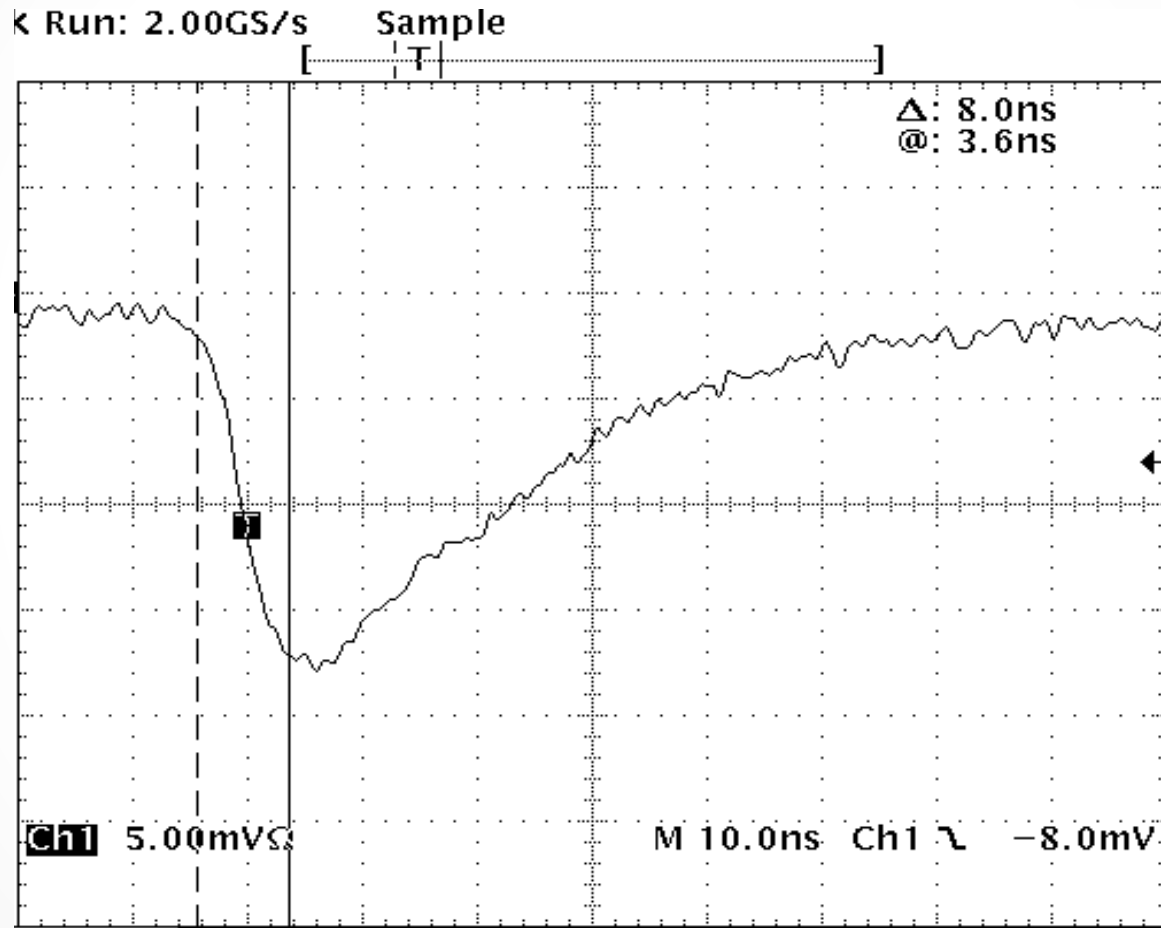
Fast timing is the measuring of lifetimes of the order of hundreds of picoseconds to the order of nanoseconds .



Source



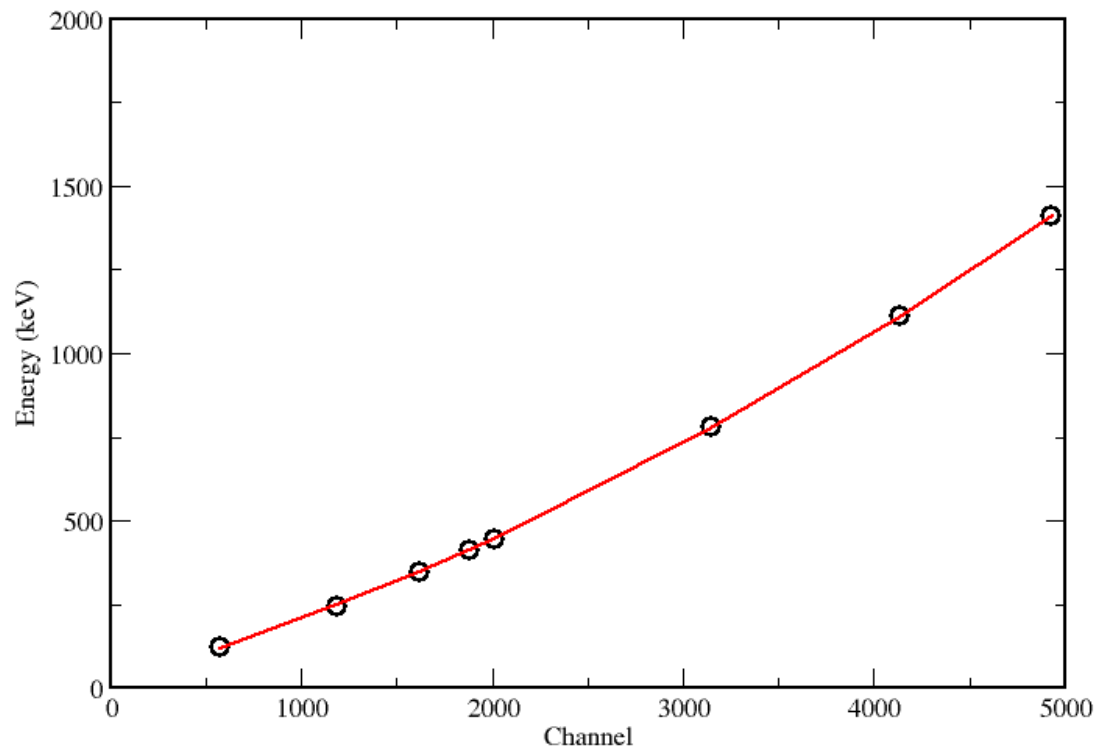
Signal from detector anode



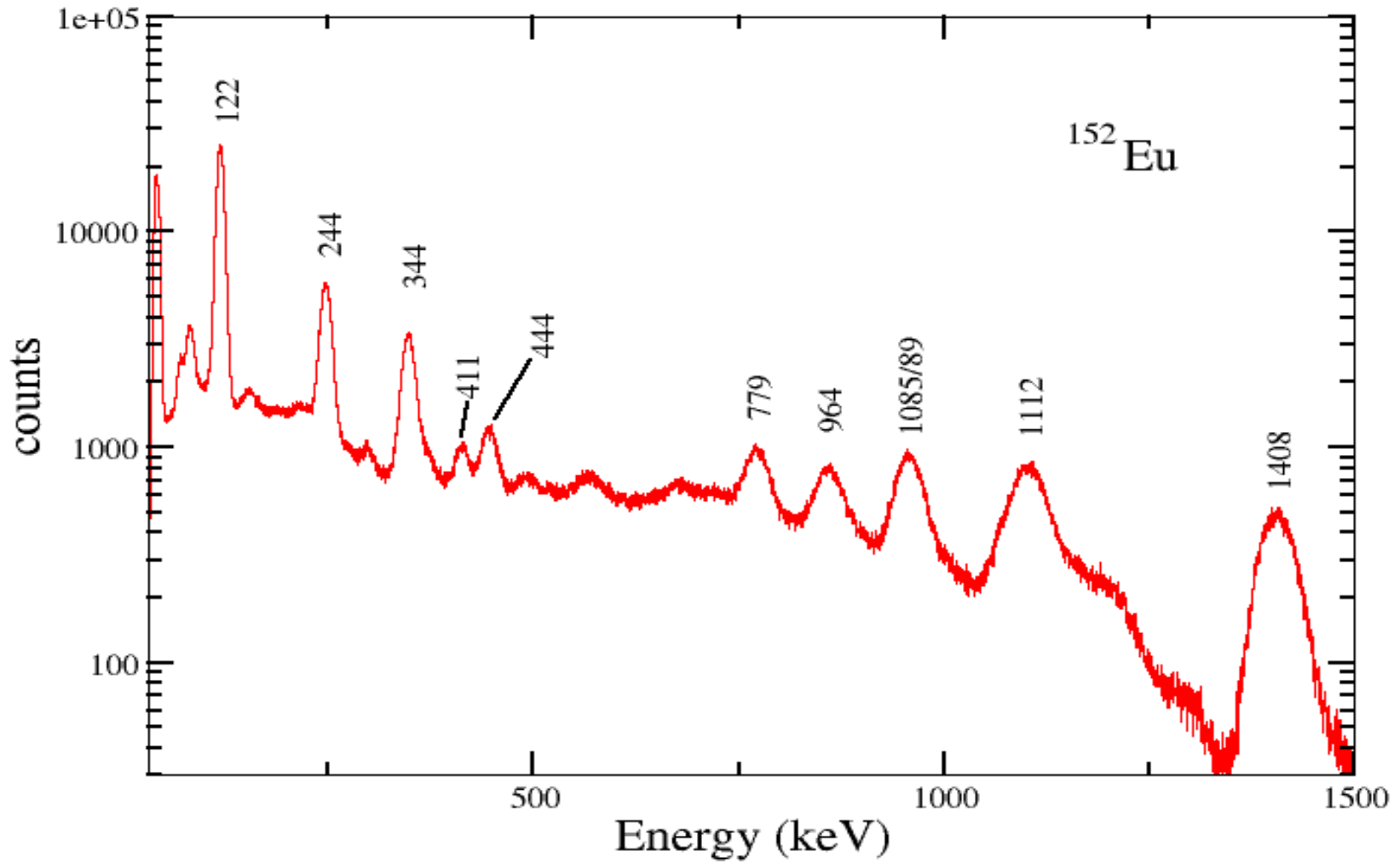
Used sources

- For energy calibration and timing - ^{152}Eu
- For evaluating time resolution - ^{60}Co

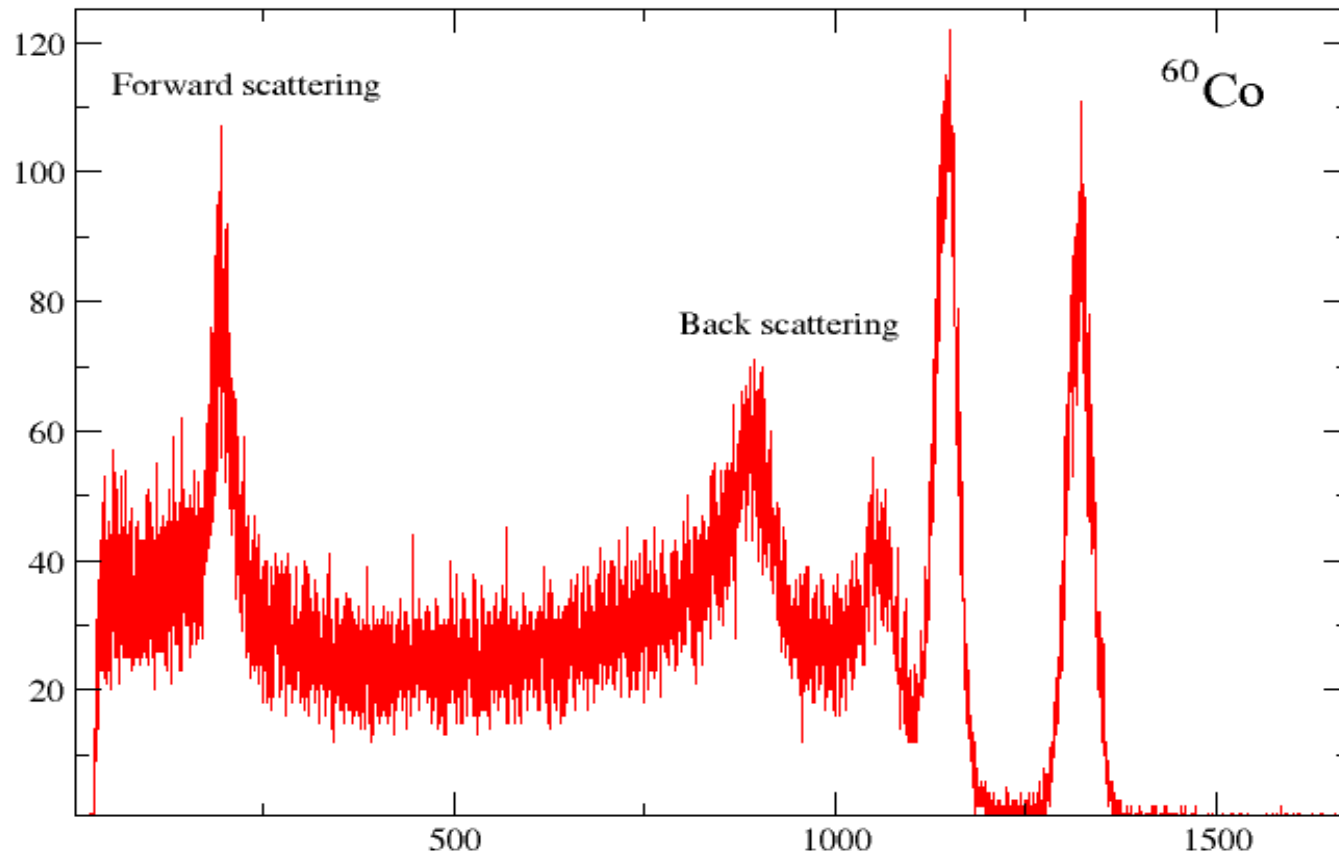
Energy Calibration



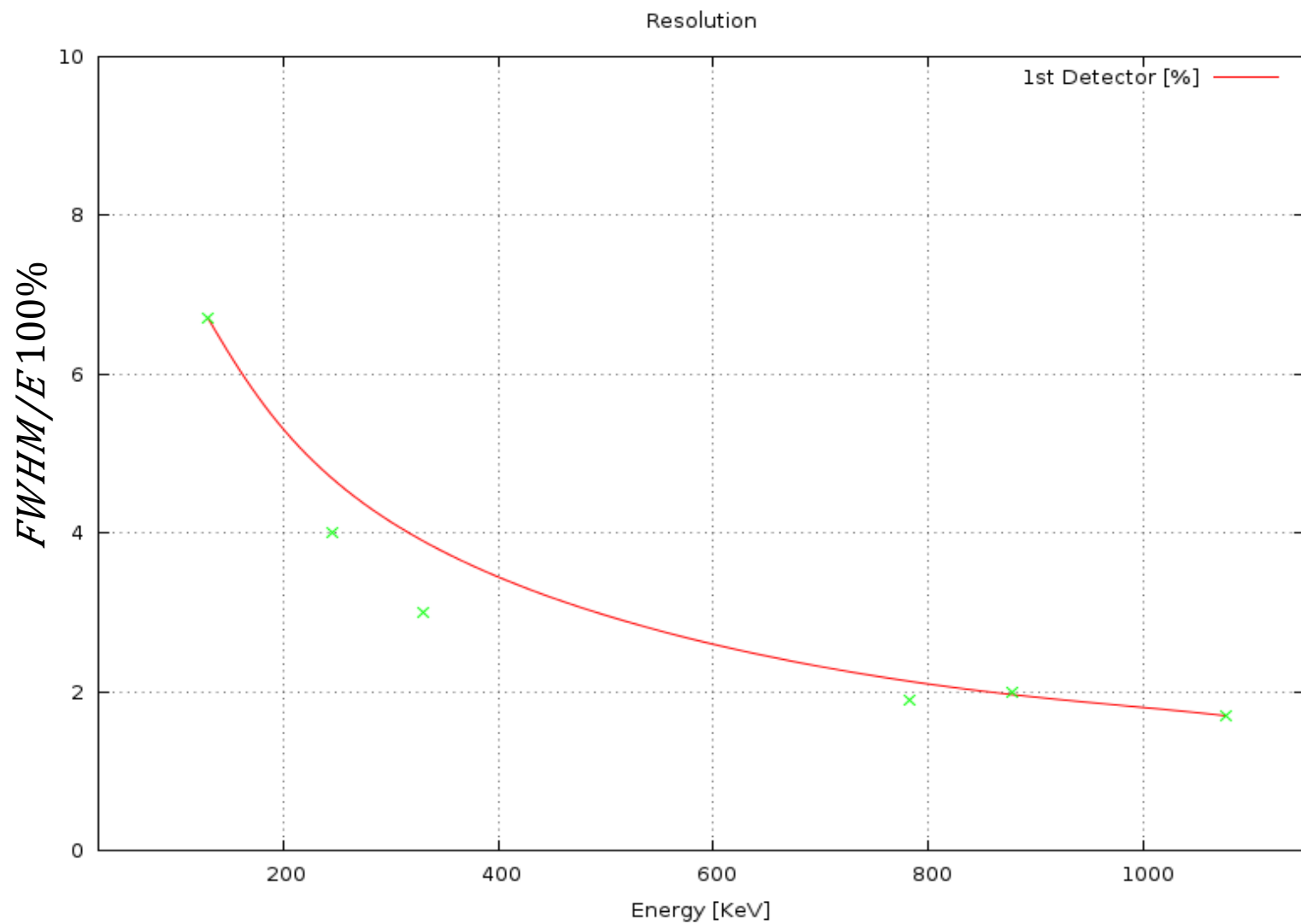
Energy Spectrum of ^{152}Eu



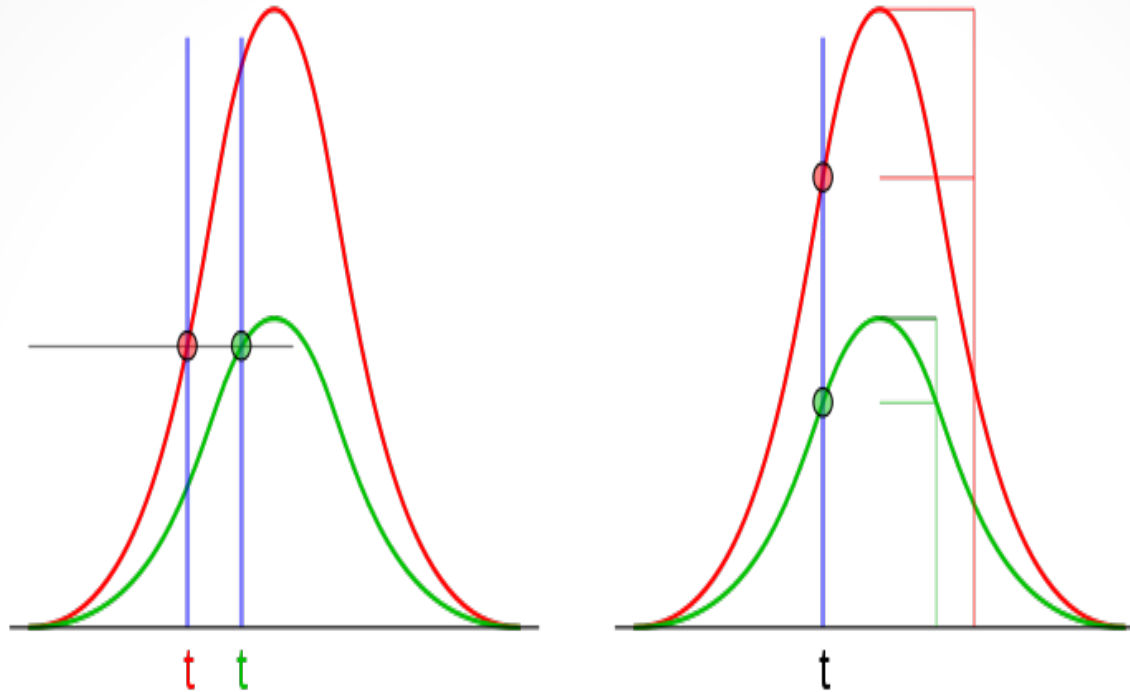
Energy Spectrum of ^{60}Co



Detector Resolution

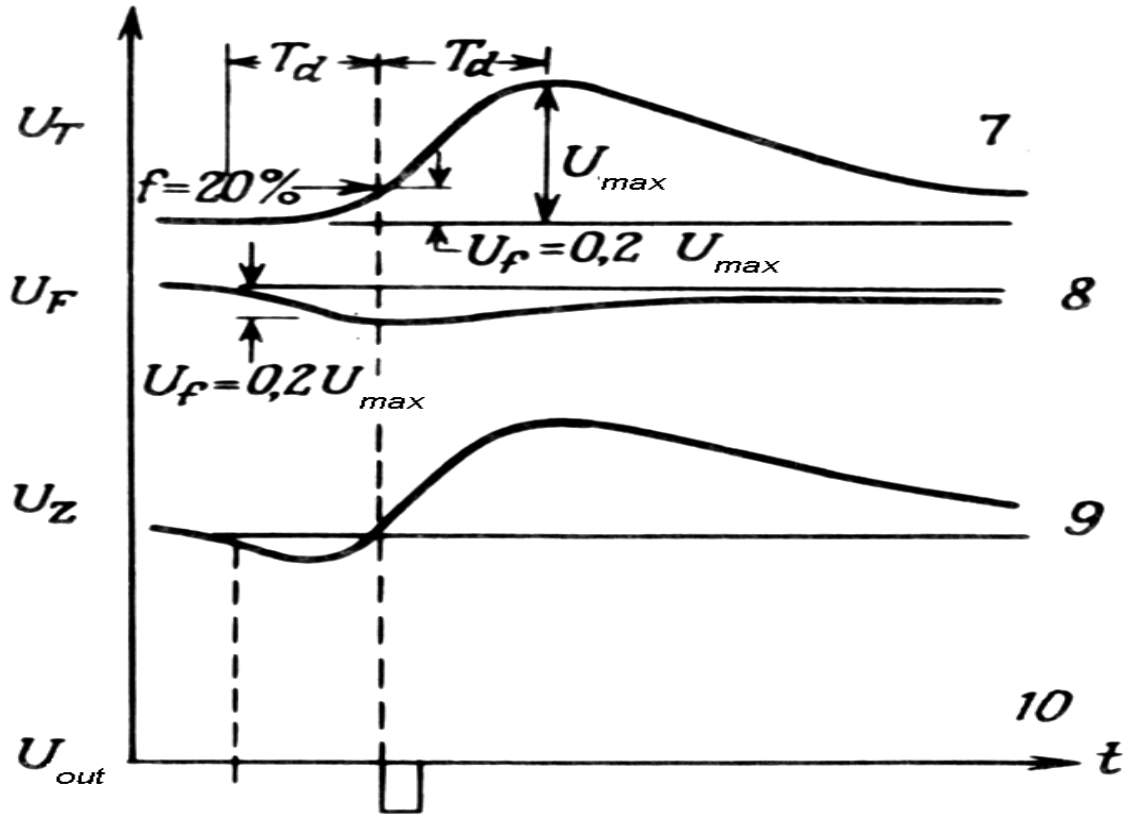


Why do we need constant fraction discriminator?

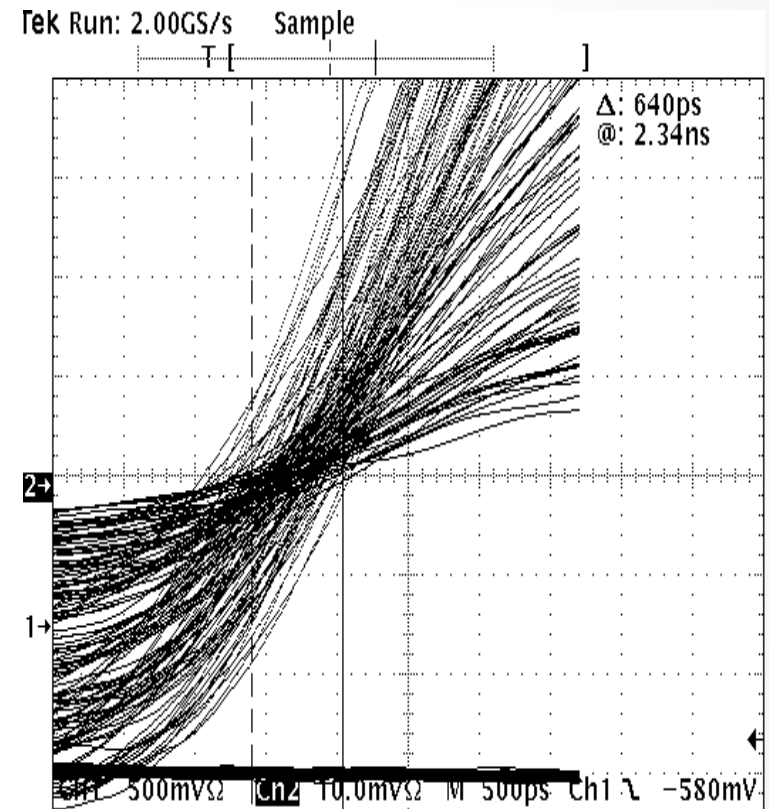
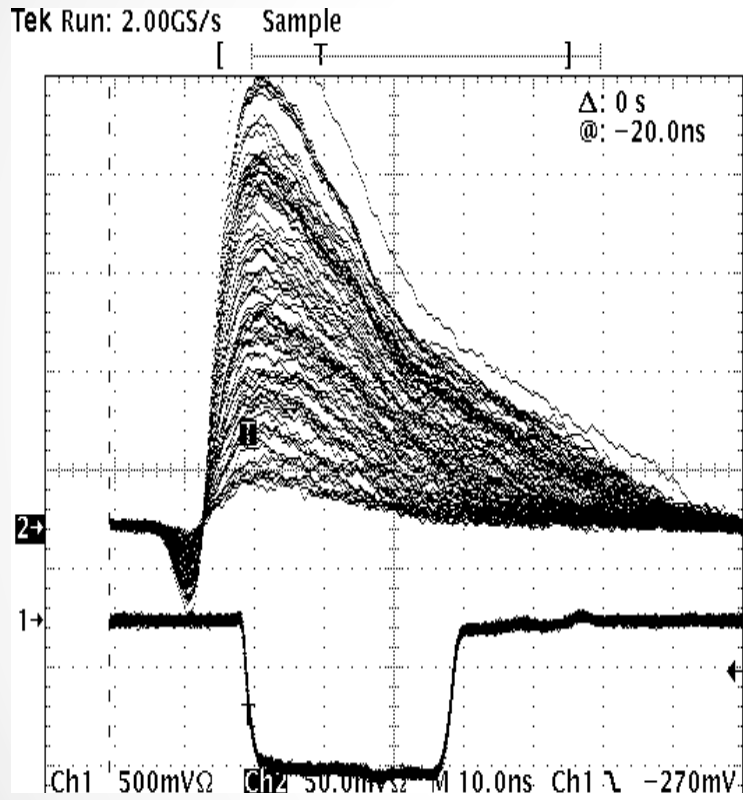


With Leading Edge Discriminator we get different times for signals coming the same time, but with different amplitudes.

Solution to the problem



Physical limitations of CFD



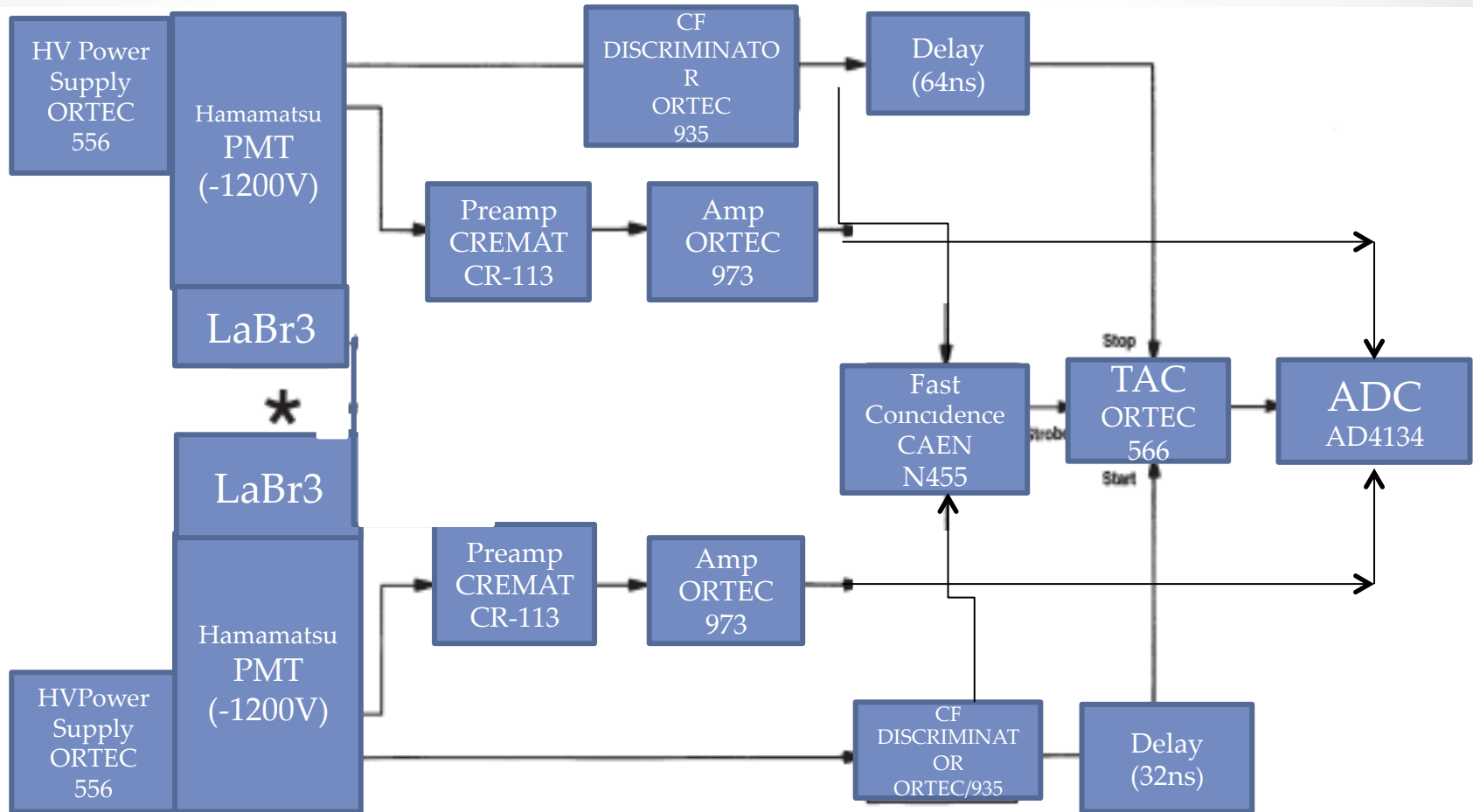
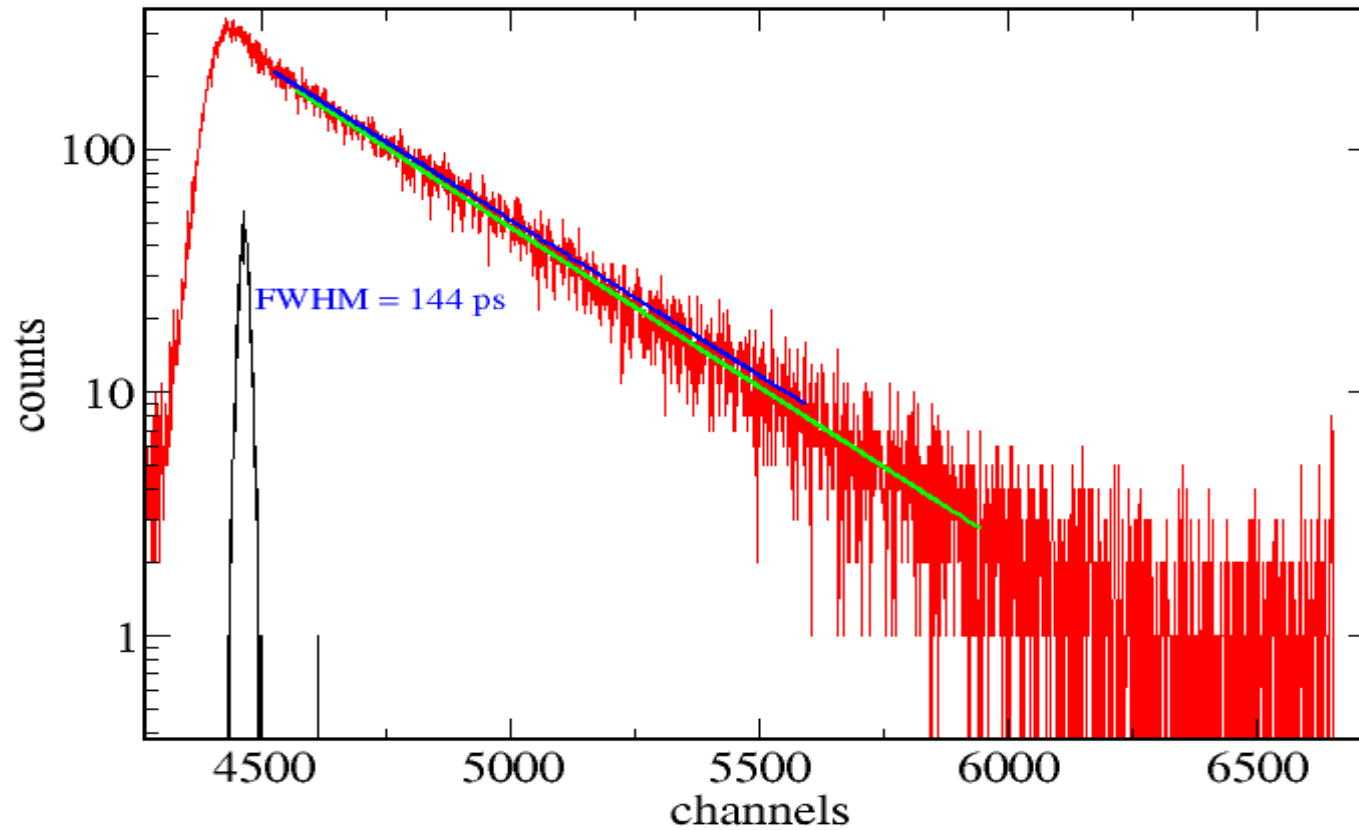


Fig. 5. Typical Fast/Slow Timing System for Gamma-Gamma Coincidence Measurements with Scintillators and Photomultiplier Tubes.

Conditions

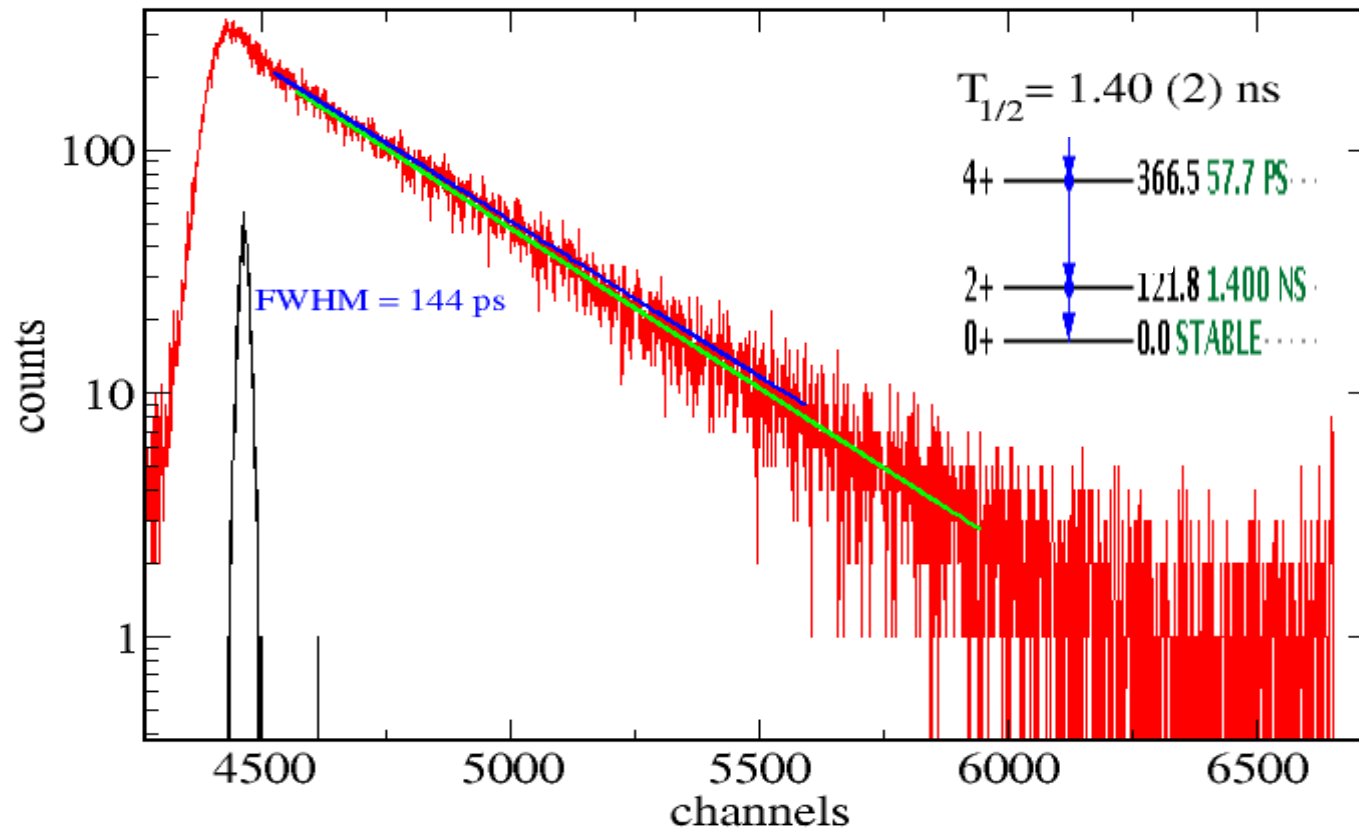
- Electronic gate – coincidence mode
- Software gate on energy peaks

Time spectrum of ^{152}Eu



- Radioactivity law - $A = A_0 \exp(-\lambda t)$
- Mean value of life - $\tau = 1/\lambda$
- Half-life - $T = \ln(2) \tau$
- $T = \ln(2)/\lambda$

RESULT



Literature $T_{1/2} = 1.43 \text{ ns}$

Conclusion

LaBr₃ detectors

- Fast detectors
- Relatively high energy resolution
- High time resolution
- Wires are the weakest part of every setup

Thank You For Your
Attention